# A FIELD ASSESSMENT OF THE FACTORS AFFECTING HORSE HAIR BLIGHT (*Marasmius equicrinis)* IN TEA IN THE RATNAPURA DISTRICT

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## *ABSTRACT*

*Horse Hair Blight (HHB) is an epiphytic fungus which is not considered phytopathogenic. However, under the hot and humid conditions prevailing in the low country, its proliferation in a habitat like tea bush canopies can cause heavy physical hindrance in major operations such as plucking and pruning. The objectives of this study were to identify the major contributory factors that influence the incidence of HHB in tea gardens while assessing the level of adoption of the recommended remedial measures. This study was conducted in tea gardens that go under water during floods and that do not, in Nivitigala and Elapatha Tea Inspector Ranges in Ratnapura. Primary and secondary data were collected and a field survey using pre tested structured questionnaires by visiting 104 randomly selected tea-small-holder-farmers. The severity of the problem in each field was assessed using the field disease key index and categorized as per the severity of disease spread. Approximately 86% of the surveyed sample has recorded HHB at different intensities. However, a majority of the cases were at moderate levels. Environmental factors seem to be the most important determinants to the occurrence of HHB. Highly significant relationships were seen between the HHB and shade level, soil texture, age of the crop and the type of cultivar. No yield reductions were observed due to HHB. However, it was found to affect the bush health. More than the social standing of the individual, the economic reasons, extent of skills of the available labour and the lack of awareness has an effect on the prevalence of the HHB.*


***Keywords:*** *HHB-Horse Hair Blight, Tea, Low Country, Sri Lanka*

## INTRODUCTION

Tea crop plays an important role in the economy of Sri Lanka and is considered the foremost plantation sector of the country. Annual production in the year 2005 was around 317 mn.kg., of which total exports amounted to 298 mn. kg, approximating 98%. This has brought in an income of Rs 85.48 billion as foreign exchange, making a contribution of 1.2 % to the GDP (Central Bank , 2005). The low country signifies the major tea-growing region of Sri Lanka in terms of both land use (79,836 ha) and production (168 mn. kg)(Anon, 2004). Of this, the Ratnapura District records the highest extent in 26,120 ha. In the recent past Horse Hair Blight (HHB) conditions associated with tea in the low country has surfaced from a level of non-significance to be a very heavy problem.

HHB is a fungus-plant cohabitation in which the involved fungus is *Marasmius equicrinis*. It is an epiphytic fungus. The fungus obtains its food from the dead outer bark of the older stems, from dead leaves and twigs in the tangle and does not derive its nourishment from living tissues (Petch, 1923; Balasuriya, 2004). Therefore, the fungus also falls within the group of Saprophytes. Other than tea (*Camellia sinensis*), it can be found on crops such as rubber, cinnamon, nutmeg, rambutan.



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Even though *Marasmius equicrinis* fungus is not considered phytopathogenic, under the hot and humid conditions prevailing in the low country, its proliferation in a habitat like tea bush canopy can cause heavy physical hindrance in major operations such as plucking and pruning. Their presence is normally prevalent under shady, humid conditions. In the recent past, this problem was found to be on the rise in tea cultivations located within the flat lands associated with riverbed, probably because they go under water during certain parts of the year, under heavy monsoonal conditions (Balasuriya *et al*., 2001).

In the control of the situation, maintenance of bush sanitation especially by physical removal of debris and the fungal strands followed by hydrated liming of the frames at pruning are of prime importance. The recent expansion of the problem is considered mainly due to the negligence of good agricultural practices with the ample support it receives with the changing climatic patterns, particularly that of the rains in the low country. Therefore the objective of this study was to identify the major contributory factors that influenced the incidence of HHB in tea gardens while assessing the level of adoption of the recommended remedial measures, particularly by the small holder sector of the low country, *Ratnapura* District which accommodates 88,218 (the highest for a district) small holdings (Department of Census and statistics, 2005).

## MATERIALS AND METHODS

This study was undertaken in collaboration with the Tea Research Institute, from March to August 2004, to determine some of the major biological factors, which influence the spread of HHB and to identify the socio economic factors that affect its management.

### *Collection of field data*

*Nivitigala* and *Elapatha* Tea Inspector Ranges in the *Ratnapura* District were specifically selected, in order to include both categories of tea gardens that go under water during floods and that do not, as they are sporadically available in these two ranges. Primary data were collected by a field survey using a structured questionnaire by visiting 104 randomly selected tea-small-holder-farmers.

The severity of the problem in each field was assessed using the following key;

None : (0) No any HHB strands on the frame.

Low : (1) Presence of a few fungal strands (≤ 10) anywhere on the bush.

Moderate : (2) Fungal strands started on the main stem, spread to several branches, but without webbing among branches.

Heavy : (3) Fungal strands started on the main stem, spread to several branches, with some loose webbing among branches.

Very Heavy: (4) Fungal strands found on main stems, all branches, including leaf surfaces creating heavy festoons of debris.

In each farmers field three plots were randomly selected, each containing 25 bushes. All the bushes in each plot were individually observed to determine the intensity of the problem using the above key. Five bushes from each individual plot were randomly selected to record the incidence of horse-hair-blight by measuring the height of bush, depth and

the radius of the plucking table, height to the starting point of the fungal threads from ground on the main stem and the radius of the spread of the fungal mat in the plucking table, using a meter ruler. The number of plucking points in the centre and on the periphery of the plucking-table, were counted using a wire circle (Wijeratne, 2001). These measurements were compared with the HHB severity index developed using visual observations.

**Table 01: Field assessment index of HHB**

| Severity of problem | Rating of the incidence |
|---|---|
| None | 0 |
| Mild | 1 |
| Average in several | 2 |
| Average in all | 3 |
| High in several | 4 |
| High in all | 5 |

The texture of the soil of the selected plots was divided into three categories; loam, sandy loam and clayey, using sensitivity test.

The level of shade in respective fields, were also categorised into three; excessive, adequate and low was determined on the basis of TRI recommendations.

Secondary data such as distribution of tea small holders and their productivity, about the disease, cultivars, physical conditions for tea cultivation and standards of various factors such as the level of shade, were extracted from TRI reports, records and articles in bulletins and journals. When comparing these factors, TRI recommendations were used as standards.

An attitude scale was developed using eight statements to study the attitude of small holders in relation to the management of HHB. A reliability test was done for the attitude scale and was categorised into three levels according to the standard deviation and the mean. They were, low attitude (those who thought that this was not a serious problem), medium attitude (those who were not certain either way) and high attitude (those who thought that this was a serious problem).

The Statistical Package for Social Sciences (SPSS) Version 10 was used, employing descriptive and inferential statistics to analyse data. For descriptive statistical techniques, frequency distribution and mean were computed to study the data. Chi-square, Correlation coefficients, reliability analysis were used to infer relationships among variables.

## RESULTS AND DISCUSSION

On an average 86% of the small holder plots recorded the presence of HHB in different degrees. This was found to be higher than that recorded in the Galle District which was 72% (Edirisinghe *et al*., 2003).

### *Influence of agronomic/cultural practices on the incidence of HHB*

This study confirmed that the level of shade, age of the crop, the cycle of pruning and the texture of soil in which plant grows had a significant effect on the incidence of HHB and its intensity.

### *i. Shade and the incidence of HHB*

There was a highly significant relationship between the levels of shade and the incidence and severity of HHB (Table 2). The highest incidence of 88% and the highest intensity of 0.634 were recorded under the heavy shade while the lowest incidence of 70% was recorded under low shade. However, the lowest intensity (0.454) of the problem was recorded under standard shade, supporting the TRI shade recommendations. In a similar study undertaken in the Galle District, there was 100% incidence under very heavy shade while an incidence of 33% was recorded under recommended shade levels (Edirisinghe *et al*., 2003). Therefore, these suggest the direct dependence of the level and intensity of HHB on the degree of shade under which tea is grown. This is probably due to the humid conditions influenced by the heavy shade, over and the higher temperatures (28.3°C) that prevail in the Ratnapura District (Tea Research Institute, 2005)

**Table 02: Shade level and the incidence of HHB in tea plants**

| Shade level | Intensity of HHB | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index(1) |
| Less | 11 | 07 | 09 | 10 | 70.2 | 0.495 |
| Standard | 55 | 45 | 30 | 11 | 73.9 | 0.454 |
| Heavy | 16 | 25 | 49 | 44 | 88.1 | 0.634 |

$X^2 = 51.718$, df = 8, P = 0.0001

### *ii. Age of crop and the incidence of HHB*

Health of a bush normally declines at later stages of life cycles, particularly when they have not been properly managed at early stages. Proving this point, a highly significant relationship was recorded between the age of the crop and the incidence of HHB in this study (Table 3). The highest incidence of 96% was seen on bushes that were more than 13 years of age and the lowest of 62% on bushes less than 8 years. Those bushes that were between 9 and 13 years recorded 92% infestation by HHB.

**Table 03: Incidence of HHB with advancing pruning cycles of tea**

| Pruning cycle | Intensity of HHB | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index(1) |
| New clearing | 09 | 03 | 12 | 03 | 67 | 0.333 |
| 1st Cycle | 01 | 05 | 11 | 03 | 95 | 0.450 |
| 2nd Cycle + | 05 | 06 | 24 | 20 | 91 | 0.518 |

$X^2 = 18.172$, df = 6, P = 0.05

***iii. Soil texture and the incidence of HHB***

Almost 97% of tea plants growing on clayey soils recorded infestation while those on loamy and sandy soils recorded 88% and 74% infestations respectively ($X^2$ = 12.830, df = 6, P = 0.05). Accordingly, it is possible that tea growing on clayey and loamy soils is more prone to infestation by HHB, compared to those growing on sandy soils. The reasons may be that those growing on clayey soils suffer due to ill-drained conditions, which prevents free growth during wet periods. Undoubtedly during the dry months they should be subjected to another stress due to caking up of surface soil layer thus depriving the plants of water whose roots are very likely to be confined to the upper soil layers.

***iv. Tea cultivar and the incidence of HHB***

Majority of smallholders plant mixed stands of tea cultivars. Almost all the seedling teas and 73% of the VP tea recorded infestations at various levels. Most prominent among them in the low country are TRI 2026, TRI 2023 and TRI 2025. Eighty two percent of the smallholders with TRI 2026 recorded HHB infestation of which 64% were in the heavy incidence category. This is probably in consequence of its particular sensitivity to adverse soil conditions. The percentage of infestation recorded in TRI 2023 was comparatively low (56%).

***v. Temporary flooding conditions and the incidence of HHB***

There was no significant effect of flooding on the incidence of HHB (Table 5). It is possible that there are other contributory factors to the incidence of the problem such as density of tea bush stand and depth of canopy. These are bound to affect to a greater extent, especially under the alluvial soil conditions that are normally associated with such lands (Edirisinghe *et al*., 2003).

**Table 04: Incidence of HHB with Soil Texture**

| Soil Texture | Intensity of HHB | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index(1) |
| Sandy | 08 | 04 | 11 | 08 | 74 | 0381 |
| Loam | 06 | 05 | 21 | 05 | 88 | 0.64 |
| Mud | 01 | 06 | 15 | 14 | 97 | 0.701 |

$X^2$ = 12.830, df = 6, P = 0.05

**Table 05: Comparison of HHB incidence in fields that are exposed and not exposed to floods.**

| Flood situation | Intensity of HHB (%) | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index |
| Affected | 04 | 05 | 11 | 08 | 85.7 | 0.607 |
| Not affected | 11 | 10 | 36 | 19 | 85.4 | 0.609 |

$X^2$ = 0.710, df = 3, P = 0.871

### *Influence of socio-economic factors on the incidence of HHB*

#### *i. Attitude of farmers towards HHB*

Most of respondents did not have adequate knowledge about the HHB problem. The attitude of majority of farmers (46%) was that of a mediocre level, and 27 percent of the respondents did not think that the HHB problem caused any serious damage to their tea cultivation. About 40% small holders were of the opinion that the HHB did not cause any yield reduction, because in their opinion the fungal strands seldom appeared on the plucking table of tea to make an impact on the crop. However, a similar proportion (40%) expected a yield reduction as a sequence of HHB.About 34% believed that this problem could be overcome purely by following cultural and mechanical control practices, while a smaller section (17%) stated that the controlling of HHB is difficult mainly due to shortages in labour.

#### *ii. Occupation of the smallholder*

The lowest recorded incidence of HHB (73%) was observed in the category of smallholders whose total dependence for livelihood was tea fields, who comprised 38% of respondents. The highest level of incidence (94%) of HHB was among the group of respondents who had other occupations as their main source of income. Thus the survey results showed that there was a significant relationship between the occupation and the extent of the problem. Fulltime smallholders experienced low incidence, while part-timers experienced very high incidence. This must be directly reflecting the degree of attention paid by the fulltime small growers on the hygiene of the tea bushes and the fields.

#### *iii. The form of labour*

The highest incidence and the intensity of HHB (95% and 0.7) was recorded in fields serviced by the hired labour (Table 7) and 82 percent of the smallholders fulfilled their labour requirement from the village and the balance from the estates in the vicinity. A difference was seen in the degree of the HHB with the source of labour. In the fields where estate workers were employed, the HHB incidence was only 61% while those fields that were serviced by village workers had 100% incidence reflecting the standards of work expected from the two categories of workers. Aside from all those considerations, those fields that were managed by family labour showed the lowest incidence (at 70% and 0.445) confirming impact of the degree of attention paid to their own crop.

**Table 06: Comparison of HHB incidence in fields that are managed by full-time and part-time smallholders.**

| Occupation | Intensity of HHB | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index |
| Full time | 11 | 08 | 17 | 06 | 65.3 | 0.391 |
| Part time | 04 | 07 | 30 | 21 | 93.6 | 0.699 |

$X^2 = 11.855$, df = 3, P = 0.008

**Table 07: Comparison of HHB incidence in fields having different forms of labour.**

| Source of labour | Intensity of HHB (%) | | | | | |
|---|---|---|---|---|---|---|
| | None | Low | Moderate | Heavy | % Incidence | Disease Index |
| Family | 10 | 07 | 11 | 05 | 69.7 | 0.445 |
| Hired | 02 | 05 | 20 | 13 | 95.0 | 0.700 |
| Family +Hired | 03 | 03 | 16 | 09 | 90.3 | 0.666 |

$X^2 = 14.128$, df = 6, P = 0.028

***iv. Knowledge and the adoption of corrective measures***

Correlation analysis indicated that there were no significant relationships among the severity of HHB problem and age, level of education of the farmer, family size and extent of land cultivated. The reason for this poor relationship could mainly be attributed to the lack of awareness of farmers of the actual HHB problem.

The level of adoption by smallholders in respect to the recommended practices was very poor. Only 10% of the respondents adopted some recommended remedial measures while the greater majority (90%) was non-adopters. Among those adopted, 10% had adopted the bush sanitation practices without any extension advice.

***v. Other factors affecting adoption***

The socio-economic factors such as the level of education, age, sex and occupation, did not show a significant influence on the adopters and non-adopters. However, some of the noteworthy factors are discussed below;

**Table 08: Relationship between the rate of adoption and the extents of land.**

| Extent of land | Rate of adoption | | | |
|---|---|---|---|---|
| | Adopters | % | Non adopters | % |
| <1 ac | 4 | 6 | 61 | 94 |
| 1 – 3 ac | 7 | 24 | 22 | 76 |
| >3 ac | 0 | 0 | 10 | 100 |

Approximately 6% and 24% of the respondents were among the adopters who owned lands, <1 ac or 1 – 3 ac, respectively. It was highlighted that high cost of inputs and the scarcity of labour were main reasons associated with non-adopters especially when the land size was increasing.

## CONCLUSIONS

The study has revealed that the Horse Hair Blight is a common occurrence in the study area. About 86% of the surveyed sample has recorded HHB at various degrees intensity. However, a majority of the cases were at moderate levels.

Environmental factors seem to be the most important determinants for the occurrence of HHB. Highly significant relationships were seen between the HHB and shade levels, soil texture, age of the crop and the type of cultivar. As previously observed by the scientists, no yield reductions were observed in consequent to the HHB. However, it was found to affect bush health.More than the social standing of the individual, the economic reasons, extent of skills of the available labour and the lack of awareness have an effect on the prevalence of the HHB.

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